Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2024
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code : 20ECT303

Course Name: Digital Signal Processing

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Compute the IDFT of the sequence {12, -4+4j, -4, -4-4j}.
2. The first five points of 8-point DFT of a real valued sequence are (0.25, 0.5-0.5j, 0, 0.5-.86j, 0). Find the remaining points.
3. Calculate the 4-point DFT of the sequence x(n)= {1, 0, 1, 0} using DIT FFT.
4. Elaborate the need for FFT and justify your answer in terms of computational complexity, memory requirement etc.
5. Explain the bilinear transformation method of IIR filter design.
6. Determine H(Z) using impulse invariant method for the analog transfer function H(s)=2/{(s+1) . (s+2) }.
7. Illustrate the direct form realization of the following system y(n)= 0.5y(n-1) - 0.25y(n-2) + x(n) + 0.4x(n-1).
8. A filter is given by the system function $H(z)=1 + (1/3)z^{-1} + (1/4)z^{-2} + (1/4)z^{-3} + (1/3)z^{-4} + z^{-5}$. Implement the filter with minimum number of multipliers.
9. Explain quantization noise in ADC.
10. What are the various computer architectures used for signal processing? Describe Harvard architecture used in microprocessors.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Determine the circular convolution of $x_1(n)$= {1, 1, 2, 1} and $x_2(n)$= {1, 2, 3, 4} using DFT- IDFT method. (7)
    b) Determine the output y(n) using overlap save method for the input sequence x(n)= {3, -1, 0, 1, 3, 2, 0, 1, 2, 1} and h(n)= {1, 1, 1}. (7)

OR

12. a) Calculate the response of the filter with x(n) = {1, 2} and h(n) = {2, 2}. (7)

b) Find the circular convolution of $x_1(n) = \{1, -1, -2, 3, -1\}$ and $x_2(n) = \{1, 2, 3\}$ using concentric circle method. (7)

MODULE II

13. a) Compute the 8-point DFT of the sequence $x(n)= \{1, 1, 1, 1, 1, 1, 1, 1\}$ using radix 2 DIT FFT. (7)

b) Determine the DFT of following real sequences using only one FFT flow graph. $x_1(n) = \{1, 1, 1, 1\}$ and $x_2(n) = \{2, 1, 2, 1\}$. (7)

OR

14. a) In an LTI system input, $x(n)= \{1, 1, 1\}$ and impulse response $h(n)= \{-1, -1\}$. Calculate the response of the system using radix-2 DIT FFT. (6)

b) Determine the 8-point DFT of the following sequence by calculating 4-point DFT. $v(n) = \{1, 2, 2, 2, 0, 1, 1, 1\}$ (8)

MODULE III

15. a) Design a ideal high pass filter with following specifications

$Hd(\omega) = 1; \pi/4 \leq |\omega| \leq \pi$
$= 0; |\omega| < \pi/4.$

Find the values of h(n) for N =11 using Hanning window. Also find the transfer function. (7)

b) Design a FIR band pass filter using frequency sampling method with the following specifications. Sampling frequency = 8000Hz, Lower cut off frequency = 1000Hz and Upper cut off frequency = 3000Hz. Determine the filter coefficients of N=7. (7)

OR

16. a) Explain warping effect? How it can be avoided? (6)

b) Design a digital Butterworth filter using BLT that satisfies the following constraints. Assume T = 1 sec. (8)

$0.707 < |H(e^{j\omega})| < 1; \quad 0 < \omega < \pi/2$
$|H(e^{j\omega})| < 0.2; \quad 3\pi/4 < \omega < \pi$

MODULE IV

17. a) Determine the direct form 1 realization of $y(n)= 0.5y(n-1) - 0.25y(n-2) + x(n) + 0.4\, x(n-1)$ (6)

b) Obtain parallel form realization of the following system $H(Z) = 3(2Z^2 + 5Z + 4)/\{(2Z+1) . (Z+2)\}$ (8)

OR

18. a) What is the need of anti-aliasing filter prior to down sampling. (6)

b) What is multi-rate signal processing? Obtain interpolated and decimated versions for the sequence x[n] = {1, 2, 3, 4, 5, 6, 7, 8} by a factor 2. (8)

MODULE V

19. a) What are the factors that influence the selection of a DSP processor? (6)

b) Explain the architecture of TMS320C67XX DSP processor with a neat diagram. (8)

OR

20. a) What are the factors involved with finite word length effects in digital filters. Explain any two effects in detail. (8)

b) The input to the system y(n) = 0.999y(n-1) + x(n) is applied to an ADC. What is the power produced by the quantization noise at the output of the filter if the input is quantized to 8 bits. (6)

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